On the Status of Contrast.
Evidence from the Prosodic Domain

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Recent models of Information Structure (IS) identify a low level contrast feature that functions within the topic and focus of the utterance. This study investigates the exact nature of this feature based on empirical evidence from a controlled read speech experiment on the prosodic realization of different levels of contrast in Modern Greek. Results indicate that only correction is truly contrastive, and that it is similarly realized in both topic and focus, suggesting that contrast is an independent IS dimension. Non default focus position is further identified as a parameter that triggers a prosodically marked rendition, similar to correction.

Keywords: Information Structure, Prosody, Contrast, Correction, Markedness

1 Introduction

The work described in this paper builds on evidence from the prosodic domain to explore questions on the status of contrast as a distinct Information Structure (IS) component, as well as its relation to other widely acknowledged IS components such as the focus and the topic of the utterance.

1.1 Contrast as part of an IS representation

Despite the divergence in opinions regarding the exact representation of IS, there are some key intuitions pertaining to all − or at least most − theoretical approaches (cf. Büring, 2007; Kruijff-Korbayová & Steedman, 2003). These intuitions refer to a) a distinction of givenness or contrast, which has been linked to notions such as referential status, denotation of alternatives made available in

context or even mere previous mentioning, and b) the association of the focused elements with the wh-element of a preceding question. The latter can be linked to proposed utterance partitions into complementary parts such as topic and focus/comment or theme and rheme, as well as notions such as presupposition, Question under Discussion (QUD) and so forth (see Jackendoff, 1972; Gundel, 1989; Steedman, 2000; Büring, 2007 among others).

Accordingly, more complex models of IS have been proposed, which incorporate the above mentioned elements into a two-dimensional view of the organization of information within the utterance (Vallduvi & Vilkuna, 1998; Steedman, 2000; Büring, 2007; Krifka, 2008). More specifically, the first dimension involves a horizontal, syntagmatic partition into a topic and a focus part (or topic-comment, theme-rheme and so forth, depending on the adapted notation and terminology). The topic part anchors the utterance to the previous discourse, while the focus part answers the underlying question, advancing the discourse and updating the common ground. The second dimension involves a vertical, paradigmatic feature of givenness or contrast among alternative discourse entities, which can function both within the topic and the focus part of the utterance. Example (1) illustrates the two dimensions. Prosodically prominent words are capitalized. "C" subscript stands for contrast, and refers to the second IS dimension.

(1)   What did the tourists want?
         The British tourist wanted to rent the blue car. (The ITALIAN$_C$ tourist)$_{TOPIC}$ (wanted to rent the RED$_C$ car.)$_{FOCUS}$

Nevertheless, there is still no consensus on the exact relation between the two dimensions (cf. Halliday, 1967; Lambrecht, 1994; Steedman, 2000; Molnár, 2002; Gryllia, 2008; Hartmann, 2008 among others). Halliday (1967), for example, considers the givenness/contrast dimension as independent of the

theme-rheme distinction. Kruijff-Korbayová and Steedman (2003), on the other hand, view the two dimensions as different, yet interdependent aspects of the same structure. In Steedman's (2000) view, the type of the Nuclear Pitch Accent assigned to the contrastive element is dependent upon the θ or ρ marking property of the element (where θ and ρ stand for theme and rheme respectively). Furthermore, in another line of research, evidence on the grammatical encoding of different *levels* of contrast (or the lack of it) is used in favor or against the postulation of an independent contrast feature (Molnár, 2002; Gryllia, 2008; Hartmann, 2008).

1.2   The different levels of contrast

Several researchers (Gussenhoven, 2007; Molnár, 2002) propose the existence of different types of contrast, based on evidence from various languages that grammatically encode them. Molnár for example identifies the following contrast hierarchy within the linguistic literature (from weaker (1) to stronger (5)):

1. mere *highlighting* through accentuation
2. existence of a *dominant contrast*, dividing the utterance into a focus and background part
3. existence of an *open set of alternatives*
4. existence of a *limited closed set of alternatives*
5. *explicit mentioning of alternatives* in the context (i.e. existence of a salient directly accessible set).

It should be noted that this hierarchy clearly diverges from the two dimensional views of IS, as it intermingles the two dimensions (e.g., "dominant contrast" and "mentioning of alternatives") applying them on the same level of structure. Furthermore, it makes no direct reference to the notion of correction. Recent work has pointed out the importance of correction as a special type of contrast

with distinct prosodic markers (Gussenhoven, 2007; Greif, 2010). It is actually the case that – in some languages at least (e.g., Efik, Basque, Mandarin Chinese) – only correction as opposed to other sub-notions of contrast is expressed differently. Nevertheless, this hierarchical approach provides useful insight on the possibility of a finer grained notion of contrast, which – once elements overlapping with the syntagmatic dimension of IS are factored out – can be incorporated in a two dimensional view of Information Structure. (2) is an example of such an incorporation where highlighting (±h), closed set (±cs) and correction (±cor) are represented as binary distinctive features.

(2)   What did the tourists want?
        The British tourist wanted to rent the blue car. (The ITALIAN$_{C[+h,+cs,-cor]}$
        tourist)$_{TOPIC}$ (wanted to rent the RED$_{C[+h,+cs,-cor]}$ car.)$_{FOCUS}$

Furthermore, with regards to the notion of correction, Vallduvi's (1992) "informational" approach can provide an account of the special status of correction. According to this approach, different IS organizations of the utterance correspond to different sets of instructions as to where and how the information (propositional content of the utterance) must be entered to the hearer's knowledge store. In this sense, correction is a more complex process, as it doesn't merely indicate the location to which updated information should be entered (as is the case with simple topics) nor does it involve a mere addition of information (as is the case with information focus). In contrast, it involves both locating *and* replacing (subtracting *and* adding) a piece of knowledge in the hearer's knowledge store. Alternatively, in a different line of research, the special status of correction may be attributed to the associated low degree of discourse expectability, which calls for a more emphatic, marked rendition (Zimmermann, 2008).

1.3   Research assumptions and hypotheses

Accordingly, in the study at hand, we took a pragmatic approach to IS, which contrary to a semantic approach, is "sensitive" to discourse related notions such as saliency, accessibility and expectability (and hence to the different levels of contrast attested, as shown below). We further assumed a two dimensional partition of IS, representing the contrast dimension as a three level contrast hierarchy (cf. example 2), the three levels being: "no contrast", "closed set of alternatives" and "correction". We then used controlled experiments to explore the prosodic realization of these three levels of contrast in Modern Greek (MG), following an autosegmental metrical approach (Ladd, 1996) for the analysis of the utterance prosody. The analysis served both a descriptive and an interpretive goal. With regards to the former, the prosodic realization of these three levels of contrast was examined within the topic and focus phrase of the utterance, to explore a) whether the different levels of contrast are prosodically encoded in Modern Greek, and b) the aspects of the phonological organization (i.e. phrasing, NPA location, NPA type) that each IS dimension affects.

Furthermore, the following hypotheses were tested with regards to the theoretical independence of the contrast feature: Assuming that contrast is primarily associated with specific words or entities bearing the NPA, different levels of contrast would most likely be reflected through differences in the phonetic and phonological properties of these words on a paradigmatic axis of prominence. Thus, if contrast is an independent IS feature, then it is more likely to have a similar prosodic realization with regards to NPA properties in both topic and focus phrases; that is irrespective of the topic-focus partition. Similarly, different types of contrast may be realized differently, but again irrespective of the topic-focus partition. Finally, marking should be stronger for correction, since it constitutes the highest, most prominent contrast level.

In the following sections, we first briefly outline the relation between prosody and IS, focusing on previous experimental evidence from Modern Greek. Next we present the experimental setup for this study and the results of the analysis. Finally we discuss key findings in light of the theoretical issues stated in the introductory section.

2   Information Structure and Prosody

It is widely acknowledged that there is a strong interaction between Information Structure and Prosody (cf. Ladd, 1996; Truckenbrodt, 1995; Selkirk, 1995; Frota, 2000; Büring, 2007, among many others). In (primarily) plastic languages (Vallduvi, 1992) such as Greek for example, focus places a strong constraint on the location of the nuclear pitch accent, forcing the material following the focused constituent to surface de-accented. Furthermore, the division of the utterance into topic and focus has been shown to align with the division of the utterance into prosodic phrases (Steedman, 2000; Baltazani, 2006). Steedman (2000) further claims that different types of nuclear pitch accents (NPAs) reflect the themehood or rhemehood status of the particular phrase. Results from Gussenhoven (2007) on the other hand indicate that different types of accents may be associated with different *types* of focus, and corrective focus in particular.

In the case of Greek more specifically, Baltazani (2006) has shown that topics in declaratives are realized with a single low tone (L*) NPA and a high boundary tone, whilst foci are produced with a single high tone (H*) NPA and a low boundary tone. The reverse pattern applies in the case of yes/no questions, where the focused word carries a L* NPA, enhancing the contrast to the question's high boundary tone, as suggested by the author. Similarly, the topicalized phrase is produced with a H* accent and a low boundary tone in

question contours, indicating that it is the boundary tone that selects the NPA type rather than some IS contrast.

With regards to the realization of contrast in Greek, Gryllia (2008) examines the realization of different types of contrast across topic and focus for direct and indirect objects in preverbal as well as postverbal position. She reports that corrective focus is realized with slightly lower frequency and intensity and shorter duration, with statistical significance varying depending on the type of object (direct-indirect), measurement point and conditions compared (direction of the effect). She further shows that simple topics differ from contrastive topics with regards to F0, intensity and duration, and that contrastive topics significantly differ from corrective foci providing evidence against the independence of a contrast feature. The results in Gryllia (2008) are not directly comparable to the work that will be presented below, first because the terminology used is different and second because of differences in the approach: Gryllia (2008) follows a holistic configurational approach, while we are working within the Autosegmental-Metrical framework of intonational phonology (see e.g., Ladd, 1996). An attempt to compare the two approaches is beyond the scope of the present paper and such a comparison will therefore not be undertaken.

3   Experimental Set Up

To test the hypotheses outlined in section 1.3, a controlled experiment was carried out examining three levels of contrast ("no contrast", "closed set of alternatives", "correction,") within topic and focus phrases in sentence initial position. All new utterances were also included. However, discussion of all new cases is beyond the scope of this paper, and results are reported based on contrast conditions alone. (3) exemplifies each level of contrast. For ease of

presentation throughout this paper reference is made to different types of topics and foci (e.g., corrective, contrastive etc.); however, what is actually meant is that there is a different level of contrast associated with the topic and the focus of the utterance, as explained below.

More specifically, "no contrast" is associated with *simple* topics and *information* focus, "closed set" is associated with *contrastive* topic and focus, and "correction" is associated with *corrective* topic and focus (see e.g., Rump & Collier (1996) and Krifka (2008) for uses of these terms). Simple topics are already established topics referring to old, already evoked entities, and information focus merely highlights the part of the utterance that is informative, giving no rise to contrast from a pragmatic point of view. In the simple topic example in (3), "lieutenant" is the already established topic based on the preceding question, while information focus simply answers the question corresponding to the wh-part.

The closed set condition, on the other hand, indicates the existence of a salient, directly accessible, limited set of alternatives that stands in relational contrast to the element in focus. In the contrastive topic example, "lieutenant" is in a set membership relationship with the already established topic "officers on the bridge". It therefore constitutes a partial topic shift, in the sense that it does not introduce a completely new topic nor does the exact same topic continue. Instead, the new topic is a subset of the previously established topic. In the QUD approach (Büring, 2003; Roberts, 1996), contrastive topics would indicate the existence of a discourse strategy to answer the question via a set of relative sub-questions (i.e. "What did the mechanic order?", "What did the lieutenant order?" etc.).The contrastive focus example also illustrates the contrast between the members of the salient and closed alternative "officers" set: [lieutenant, mechanic].

(3)   Contrast Types

Simple Topic	[ti 'ekane o ipo'pliarxos] What did the lieutenant do? [(o ipo'pliarxos)ST 'ðjetakse tin e'cenosi tu 'pliu] (The lieutenant)ST ordered the evacuation of the ship.
Contrastive Topic	[ti 'ekanan i 'ðio aksiomati'ci] What did the two officers do? [o mixani'kos iðo'piise tin aktofila'ci. (o ipo'pliarxos)CT 'ðjetakse tin e'cenosi tu 'pliu] The mechanic notified the coastguard. (The lieutenant)CT ordered the evacuation of the ship.
Corrective Topic	[ti 'ekane o mixani'kos] What did the mechanic do? [(o ipo'pliarxos)CorT 'ðjetakse tin e'cenosi tu 'pliu] (The lieutenant)CorT ordered the evacuation of the ship.
Information Focus	[pços 'ðjetakse tin e'cenosi tu 'pliu] Who ordered the evacuation of the ship? [(o ipo'pliarxos) IF 'ðjetakse tin e'cenosi tu 'pliu] (The lieutenant)IF ordered the evacuation of the ship.
Contrastive Focus	[pços 'ðjetakse tin e'cenosi tu 'pliu. o ipo'pliarxos 'i o mixani'kos] Who ordered the evacuation of the ship? The lieutenant or the chief mechanic? [(o ipo'pliarxos)CF 'ðjetakse tin e'cenosi tu 'pliu] (The lieutenant)CF ordered the evacuation of the ship.
Corrective Focus	[o mixani'kos 'ðjetakse tin e'cenosi tu 'pliu] The mechanic ordered the evacuation of the ship. [(o ipo'pliarxos)CorF 'ðjetakse tin e'cenosi tu 'pliu] (The lieutenant)CorF ordered the evacuation of the ship.

Finally, correction rectifies misconceptions on the part of the hearer replacing information that is already part of his knowledge store. It directly contrasts with the respective element to be replaced. As well as being contrastive, it is also exhaustive (with reference to the set of entities under discussion). Accordingly, in both corrective topic and focus "lieutenant" replaces "mechanic" in the corresponding entry in the hearer's knowledge store. In the case of topic, it also results in a complete topic shift: in (3) "lieutenant"

introduces a completely new topic compared to the "mechanic". More specifically, the speaker corrects the hearer's misconception that the current discussion is about the mechanic rather than the lieutenant. It should be noted that this exchange is rather uncommon, referring to instances in which a serious "breakdown" in communication has occurred, and in which speakers may typically resolve to lengthier and more elaborate responses, in order to set the conversation back on track. In contrast, in the case of corrective topic, intonation is utilized, in order to provide a "swifter" and – in this sense – more economical response. Similarly, in the case of corrective focus, the negation particle [oçi] ("no") in the beginning of the response utterance was intentionally avoided, as it is also used to express/intensify the speech act of correction, and could thus interfere with the realization of corrective focus reducing its effects.

Target topic and focus phrases consisted of a single content word. In order to be able to measure the effect of /s/-voicing (see below for details on the use of /s/ voicing), the materials were constructed in such a way that the target word ended in /s/, and the subsequent word began with a voiced obstruent or nasal. Furthermore, target words had non-initial and non-final stress, in order to avoid any tonal crowding effects, and allow "room" for the accents to be "properly" realized.

There were four lexicalizations per condition, following disambiguating questions and statements aiming to elicit "context" appropriate speaker responses. The complete set of trigger and target materials is presented in the Appendix. All utterances were produced by 8 speakers of Athenian Greek, 2 males and 6 females (ages ranging from 19 to 36), resulting in a total of 224 (7x4x8) tokens; 192 (6x4x8) tokens if all new sentences are excluded. To avoid priming effects, materials were presented in random order and were part of a single larger recording session, in which two different experiments were conducted serving at the same time as distracters to one another. Subjects were

asked to read both the trigger and the target phrase from a Powerpoint slide show at their own pace. Recordings were conducted in a silent room using an Olympus Linear PCM Recorder LS-10 microphone. The acoustic signal was digitized to 16-bit count accuracy at a 44.1 kHz sampling rate.

Materials were then subjected to both phonological and phonetic analysis. In particular, the resulting corpus was annotated for pitch accent type and local F0 minima and maxima. Annotation was based on GRToBI guidelines (Arvaniti & Baltazani, 2005). GRToBI builds on the original ToBI annotation system (Silverman et al., 1992), identifying the following 5 main types of pitch accents for Greek: L*+H, L+H*, H*+L, H* and L*, where H and L represent high and low level tones respectively, and "*" denotes the central tone associated to the syllable bearing the main word stress.

Furthermore, measurements were taken of: duration (stressed vowel/syllable), mean intensity (stressed vowel/syllable), pre-boundary lengthening (duration from the end of the accented syllable to the end of the target phrase) and /s/ voicing. Measurements of pre-boundary lengthening and /s/ voicing were used as a more objective indication of phrasing. With regards to pre-boundary lengthening, longer duration of the segmental material at the end of a phonological phrase has been shown to correspond to a stronger boundary (Kainada, 2009). As for /s/ voicing, even though recent studies (Pelekanou & Arvaniti, 2001; Baltazani, 2006) suggest that /s/ voicing is a gradient, optional phenomenon and cannot serve as a full proof criterion for the detection of prosodic structure, it may still be assumed that a lower degree of assimilation is more probable in the case of high level boundaries, and could thus serve as an indication of prosodic constituency. For the purposes of this study, the degree of /s/ voicing was expressed proportionally as the duration of /s/ voicing divided by the total duration of /s/, in order to control for any durational variation of /s/ caused by preboundary lengthening and inter-speaker differences. Signal

analysis was performed using Praat (Boersma & Weenink, 2005). Statistical tests were run using IBM's SPSS software. Unless otherwise stated, statistical analysis results are reported for two-way repeated measures ANOVAs with IS_Partition (levels: topic, focus) and Contrast_Level (levels: no contrast, closed set, correction) as factors. To assess the direction of the effect, follow up paired samples t-tests with Bonferroni correction were conducted. It should be pointed out that due to the limited amount of data statistical analysis results should be treated with caution.

4   Results

Figure 1 shows the distribution of PAs across different types of foci and topics. L* and L*+H were the typical accents for simple and contrastive topics with the latter being more frequent (22% and 78%, and 34% and 66% for simple and contrastive topics respectively). Furthermore, 68% and 52% of the L*+H accents in simple and contrastive topics respectively were found in pre-nuclear position based on GRToBI break indices distribution.

In contrast, corrective topics were consistently produced with a L+H* accent (94% of total cases) and delimited by an intonational phrase break. In ~66% of the corrective topic renditions the break occurred immediately after the subject (i.e. the target word), whilst in ~19% of the cases the break occurred after the verb and before the focused object. In both renditions the L+H* accent aligned with the subject, but in the second rendition the verb was produced within a compressed pitch range. Figures 3 and 4 illustrate the two renditions respectively. The remaining 15% of the corrective topic renditions corresponds to cases where – contrary to what was expected – speakers dephrased and deaccented the whole subsequent material, assigning utterance prominence to

the topic rather than the focus phrase. This behavior may be due to the fact that corrective topics are uncommon, and speakers resort to more familiar renditions.
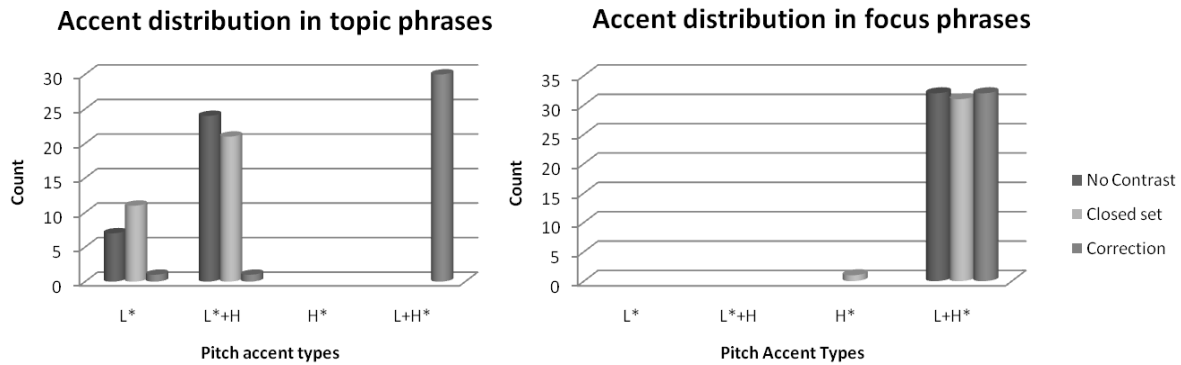
Figure 1 Accent distribution in topic and focus phrases

Similarly to corrective topics, all types of focus were also produced with a L+H* accent; the only difference between corrective topic and focus is that in the case of focus the whole subsequent phrase following the focused subject got deaccented (Fig. 5).
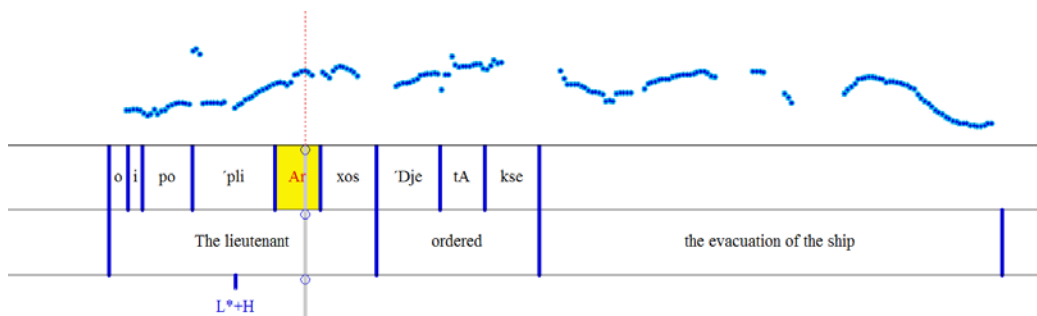
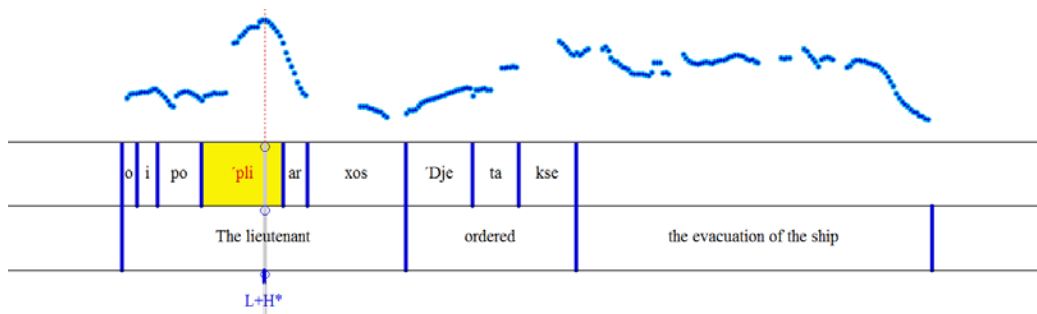**Figure 2 Simple and contrastive topic rendition (L*+H)**

Figure 3 Corrective topic rendition (L+H*) - phrase break after the subject
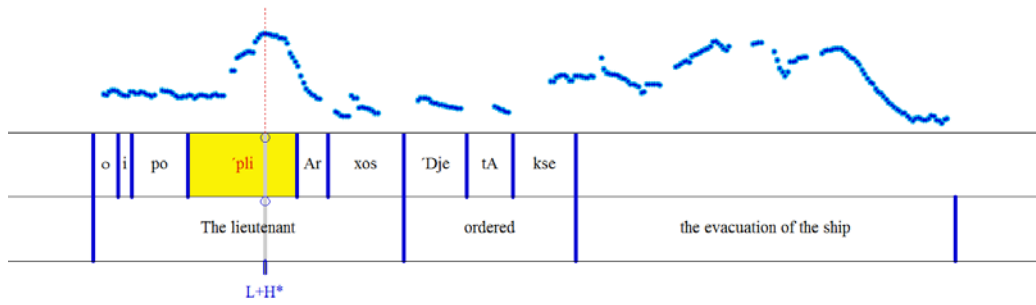
Figure 4 Corrective topic rendition (L+H*) - phrase break after the verb
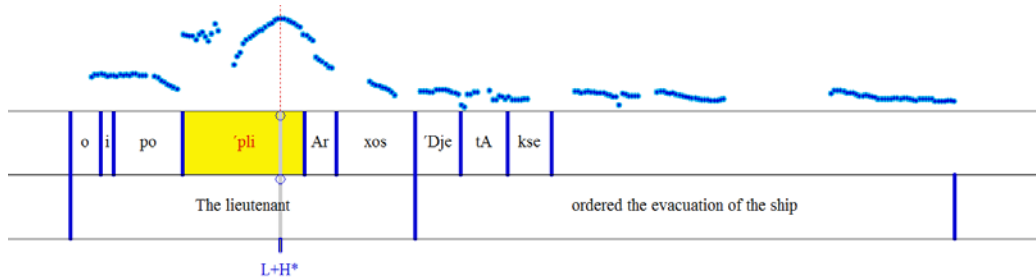
Figure 5 Sentence initial focus rendition (L+H*)

To verify the validity of the annotation, alignment measurements of local F0 maxima were also taken, expressed as a percentage of the accented syllable duration (distance of the H target from the beginning of the syllable divided by the syllable duration). Values over 100% correspond to late alignment of the H target in the post-accentual syllable. Values below 100% correspond to alignment within the accented syllable. The former corresponds to a typical L*+H accent, while the latter to a L+H* accent. Accordingly, simple and contrastive topics, which were rendered with an L*+H accent, display a mean value over 100% (Figure 6). A one way univariate Anova was conducted to further validate the correlation between accent type and H target alignment, showing a statistically significant effect of the former on the latter ($F(1) = 582.031$, $p < 0.0001$). Furthermore, a two way RM Anova was run to assess the effect of IS Partition and Contrast Level (cf. section 3) on H target alignment. The effect was found to be significant for both IS Partition ($F(1,15) = 117.95$, $p<0.0001$, $\eta^2_{partial} = 0.887$) and Contrast Level ($F(2,30) = 31.3$, $p < 0.0001$, $\eta^2_{partial}$

= 0.676). Follow up paired samples t-tests with Bonferroni correction showed that correction significantly differed from other contrast levels in the case of topics alone. In addition, there was no statistically significant difference between corrective focus and corrective topic.

Furthermore, scaling measurements of the H target were taken. As the distribution of F0 minima and maxima pairs was not even across speakers and tokens (20 % of topic phrases were produced with an L* accent lacking a corresponding H target and were thus not included in the analysis), a semitone scale was used for normalizing F0 values, and allowing for a better comparison. The following formula was used for converting F0 values in Hz to semitones:

$$F_{st} = 12 \ (\log_2 f_{hz} - \log_2 k)$$

where f_{hz} is the original F0 value of the H target in Hz and k is a speaker dependent reference value equal to the F0 value (Hz) of the corresponding L target. Scaling measurements indicate that correction was produced within a greater F0 range for both topic and focus, as shown in figure 6. The difference was shown to be statistically significant for IS Partition ($F(1,15) = 6.85$, $p = 0.019$, $\eta^2_{partial} = 0.313$) and Contrast Level ($F(2,30) = 4.963$, $p = 0.013$, $\eta^2_{partial} = 0.249$). However, follow up tests indicate that there was no statistically significant difference between different contrast levels within topic and focus, nor between corrective topic and focus.
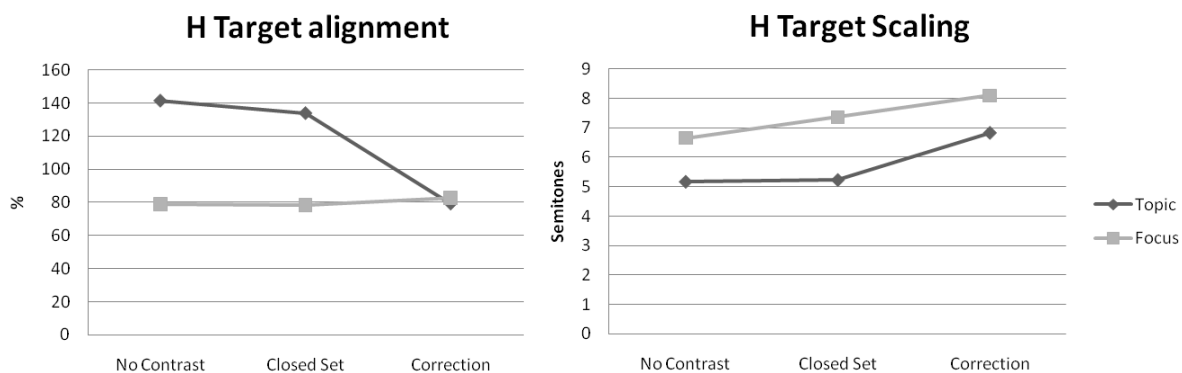
Figure 6 Alignment (expressed as a proportion of syllable duration) and scaling of the H target.

Figure 7 presents the results for the stressed syllable intensity (mean) and duration. Focus is realized with increased intensity compared to simple and contrastive topic. Corrective topics on the other hand are realized with a mean intensity at approximately the same levels as foci. Analysis of variance revealed a significant effect of both IS Partition ($F(1,31) = 29.015$, $p < 0.0001$, $\eta^2_{partial} = 0.483$) and Contrast Level ($F(2,62) = 17.533$, $p < 0.0001$, $\eta^2_{partial} = 0.361$). Follow up t-tests showed that correction significantly differed compared to other contrast levels in the case of topic alone, and that there was no statistically significant difference between corrective topic and corrective focus.

With regards to duration, corrective topics are realized with a higher duration compared to other types of topics as well as corrective focus. The effect of Contrast Level was found to be statistically significant ($F(2,62) = 0.519$, $p < 0.0001$, $\eta^2_{partial} = 0.519$) contrary to the effect of IS Partition ($F(1,31) = 0.495$, $p = 0.487$, $\eta^2_{partial} = 0.015$). Pairwise comparisons showed that correction significantly differed from other contrast levels for both focus and topic. Corrective topic and focus also differed in pairwise comparisons.
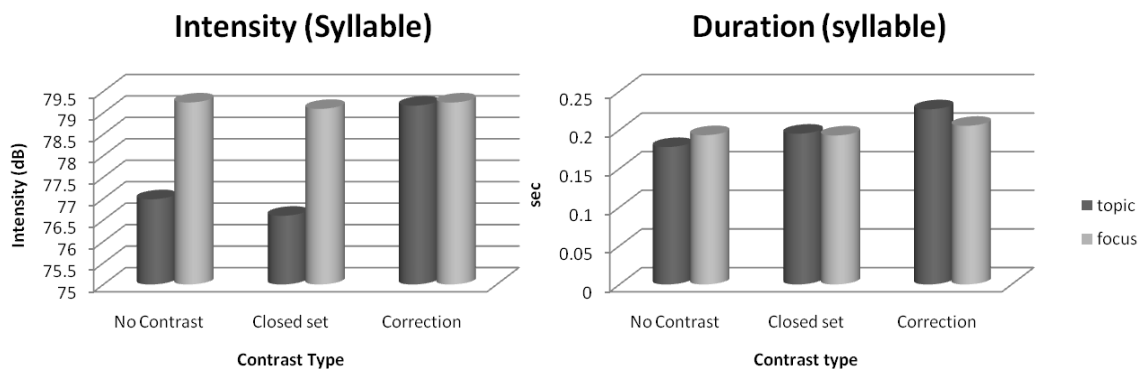
Figure 7 Intensity and duration measurements per contrast level and phrase type

As far as phrasing is concerned, results on /s/ voicing and pre-boundary lengthening have slightly contradictory implications. More specifically, the percentage of /s/ voicing is higher for topics, indicating a weaker boundary

(Figure 8). On the other hand, duration of pre-boundary material is more or less the same across conditions (with the exception of corrective topics), indicating a boundary of equal strength. Nevertheless, results on both /s/ voicing and pre-boundary lengthening corroborate the special status of correction in topics. Corrective topics were produced with a stronger boundary, as implied by the decreased voicing percentage and the increased pre-boundary lengthening value respectively. According to RM Anovas the effect on /s/ voicing was not statistically significant. In contrast, the effect on lengthening was statistically significant for both IS Partition ($F(1,31) = 10.329$, $p = 0.003$, $\eta^2_{partial} = 0.25$) and Contrast Level ($F(2,62) = 26.806$, $p < 0.0001$, $\eta^2_{partial} = 0.464$). Follow up tests indicated that correction differed from other contrast levels within topic alone. Corrective topic and focus also differed in pairwise comparisons.
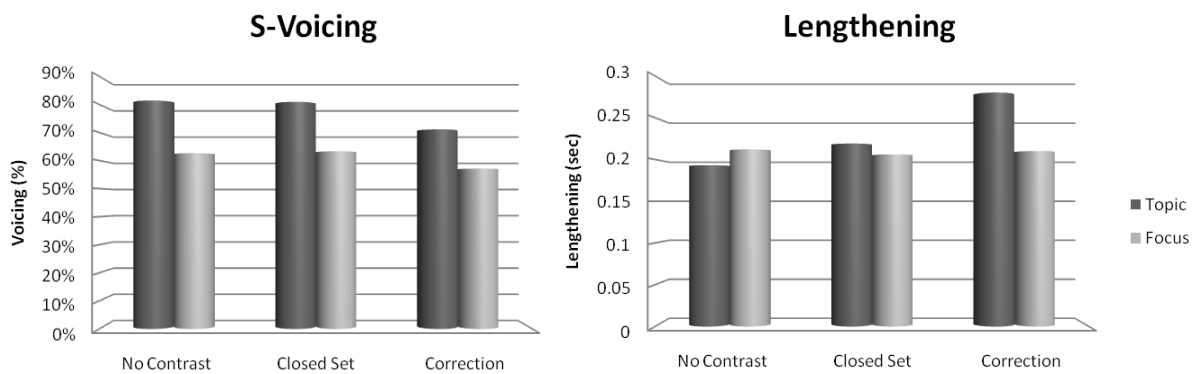
Figure 8 /s/ voicing and pre-boundary lengthening results

5 Discussion

The results of this pilot study support the special status of correction in the grammar. With regards to topics, only correction is consistently distinguished from other contrast levels within topic phrases, as it is produced with a different, more emphatic pitch accent, stronger boundary, increased intensity and duration. Furthermore, if parameters related to phrasing and syntagmatic prominence are factored out (i.e. lengthening, duration, deaccenting), then correction is prosodically realized in the same manner (L+H* nuclear pitch accent) in both

topic and focus. The latter similarity between topics and foci is in line with our initial hypothesis supporting the postulation of an independent low-level contrast feature (c-feature hereafter) that functions within both topic and focus and is associated with similar phonological and phonetic cues on a paradigmatic axis of prominence. In Modern Greek (MG), this c-feature surfaces prosodically marked in the case of correction only, indicating that with regards to MG prosody at least, only correction is truly contrastive.

Nevertheless, if correction corresponds to a structurally encoded independent feature, we should expect a similar effect of correction for the focus condition as well. However, the effect is much more subtle in the case of focus, as correction is produced with the same accent as the other contrast levels, showing minor gradual variation in the remaining of the parameters examined (increased H target F0 and duration in particular). Based on empirical evidence from related studies on contrast in MG[1], we argue that this more or less similar rendition of different contrast levels is due to the sentence initial position of the focus phrase. More specifically, Stavropoulou et al. (2010, 2012) show that correction is distinguished from other contrast levels on the basis of PA type (L+H*), when the focused word is in *sentence final* position; that is, in sentence final position there was a significantly higher variation in the distribution of NPAs for the "no contrast" and "closed set" conditions (ranging from H*, to H*+L, to L+H*) compared to correction, in which case L+H* was the predominant accent. In contrast, in the study at hand, all focus types were indiscriminately rendered with an emphatic L+H* accent, resulting in the neutralization of the correction vs. no contrast/closed set opposition in *non final* position. This latter empirical finding may be attributed to the fact that sentence

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[1]   With the exception of Gryllia (2008), as noted in section 2.

initial position[2] is the non default and arguably least predictable NPA position in Modern Greek. Therefore speakers are more likely to resort to an increasingly marked rendition, so as to efficiently draw the hearer's attention to the informative part of the utterance (signaled by the presence of the NPA), speeding up processing and facilitating understanding. Accordingly, the following continuum of markedness is proposed (in rising value of markedness): NPA default position, −contrast → NPA default position, +contrast → non default position, −contrast → non default position, +contrast.

It is further argued that the NPA type is determined by the contrast feature alone, contrary to what has been suggested in the literature for English for example, where different types of NPAs are claimed to be a reflection of the topic-focus distinction instead (Steedman, 2000). Apart from the use of the same L+H* accent for both corrective topic and focus, the above argument is further supported by the interchangeable use of the same tonal patterns for the topic and focus phrases conditioned on the sentence type (declarative vs. interrogative) in which they appear (cf. section 1.2). Therefore, in structurally non-contrastive conditions, the NPA type seems to depend more on the boundary tone (and consequently on the discourse role of the utterance as a whole) rather than the topic-focus partition. A similar high correlation between NPA type and boundary tone type has been shown in Dainora (2002), suggesting that it is the boundary tone that selects the NPA type, unless contrast imposes the use of a marked emphatic accent (such as the L+H* accent) instead.

On a final note, even though a comparison between all new/topic-less sentences and sentences with topic is beyond the scope of this paper, it is worth pointing out the following. Preliminary results indicate that there is no

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[2] Confer evidence from Rump and Collier (1996), and Watson, Arnold and Tanenhaus (2008) among others. For Greek, interested readers may refer to Revithiadou (2004) and Baltazani (2003, 2007) for a discussion of tonal patterns in neutral sentences.

significant difference in the prosodic realization of all new utterances compared to simple and contrastive topics. Given that the distinctive rendition of corrective topics can be ascribed to the low level c-feature alone, one could argue that topichood itself – as a more general notion of aboutness – is not reflected on the prosody of MG, with regards to both pitch accent type and phrasing. This is in line with e.g., Büring (2007) who associates aboutness with intonationally unmarked background material. Furthermore, as indicated by the results of this study, the accent domain of the c-feature in corrective topics may range to merely include the subject of the sentence or – less frequently – the "non-traditional" subject-verb constituent. In 19% of the corrective topics produced in this study the boundary tone delimiting the "accent" domain of the c-marked subject aligned at the end of the verb of the sentence. In this case, the verb was de-accented, so that the pitch accent of the c-marked subject would become rightmost and hence most prominent in its domain (nuclear pitch accent). Based on the above, the accent domain of the c-feature in topics does not necessarily correspond to the subject of the sentence, and is primarily constrained on the location of the c-marked constituent in the focus part, in the sense that the latter should be rightmost and there can of course be no overlap between the two accent domains.

Appendix

The appendix contains the four lexical sets that were used in the production experiment. Instantiations within each lexical set corresponding to different experimental conditions are presented in the following order: simple topic (1), corrective topic (2), contrastive topic (3), information focus (4), contrastive focus (5), corrective focus (6). In the case of corrective topic and focus

additional context is provided. For reasons of space, we only give the English translation of the additional context.

Lexical set 1

1.   *Trigger phrase*
        [ja ti   'milise   o   kaɟe'larios]
        of what speak-3SG   the-NOM chancellor-NOM
        "What did the chancellor speak of?"
        Target phrase
        [o   kaɟe'larios   'milise   ja ana'pofefkti   xreoko'pia]
         the chancellor-NOM speak-3SG of inevitable-ACC bankruptcy-ACC
        "The chancellor spoke of inevitable bankruptcy."

2.   *Trigger phrase*
        [ti   'ipan   i   'ðio   'sineðri]
        what speak-3PL the-NOM two-NOM   convention.participants-NOM
        "What did the two convention participants spoke of?"
        Target phrase
        [o   ipur'ɣos   'milise   ja ti   'lipsi   'neon
         the-NOM minister-NOM speak-3SG   of the-ACC taking-ACC new-GEN
        'metron]
        μέτρων.
        measures-GEN
        [o   kaɟe'larios   ' milise   ja ana'pofefkti   xreoko'pia]
         the chancellor-NOM speak-3SG of inevitable-ACC bankruptcy-ACC
        "The minister spoke of taking new measures. The chancellor spoke of inevitable bankruptcy."

3.   *Context*
        "The conversation is about the meetings of the Greek prime minister in Germany and the subsequent press conference. Your interlocutor has misunderstood and is under the impression that the prime minister met with the German minister of finance and that they made statements together. However, the prime minister actually met with the chancellor. So your interlocutor wants to know what statements were made, however he/she thinks the statements were made by the minister of finance. You need to correct this misconception and at the same time answer what it was that the chancellor stated."

Trigger phrase
[o   ipur'ɣos   ti   'ipe]
the-NOM   minister-NOM   what   say-3SG
"What did the minister say?"
Target phrase
[o   kaɟe'larios   ' milise   ja ana'pofefkti   xreoko'pia]
 the-NOM   chancellor-NOM speak-3SG of inevitable-ACC bankruptcy-ACC
"The chancellor spoke of inevitable bankruptcy."

4.   *Trigger phrase*
[pços 'milise   ja ana'pofefkti   xreoko'pia]
who   speak-3SG of inevitable-ACC   bankruptcy-ACC
"Who spoke of inevitable bankruptcy?"
Target phrase
[o   kaɟe'larios   ' milise   ja ana'pofefkti   xreoko'pia]
 the-NOM   chancellor-NOM speak-3SG of inevitable-ACC bankruptcy-ACC
"The chancellor spoke of inevitable bankruptcy."

5.   *Trigger* phrase
[pços 'milise   ja ana'pofefkti   xreoko'pia]
who   speak-3SG of inevitable-ACC   bankruptcy-ACC
[o   kaɟe'larios   'i   o   ipur'ɣos   mas]
the-NOM   chancellor-NOM   or   the-NOM minister-NOM   our
"Who spoke of inevitable bankruptcy? The chancellor or our minister?"
Target phrase
[o   kaɟe'larios   ' milise   ja ana'pofefkti   xreoko'pia]
 the chancellor-NOM speak-3SG of inevitable-ACC bankruptcy-ACC
"The chancellor spoke of inevitable bankruptcy."

6.   *Context*
         "The interlocutor has misunderstood."
         Trigger phrase
         [o   ipur'ɣos   ikonomi'kon 'milise   ja ana'pofefkti
         the-NOM minister-NOM   finance-GEN speak-3SG   of inevitable-ACC
         xreoko'pia]
         bankruptcy-ACC
         "The minister of finance spoke of inevitable bankruptcy."
         Target phrase
         [o kaɟe'larios   ' milise   ja ana'pofefkti   xreoko'pia]
          the chancellor-NOM speak-3SG of inevitable-ACC bankruptcy-ACC
         "The chancellor spoke of inevitable bankruptcy."

Lexical set 2

1.   *Trigger phrase*
         [pu   nosi'levete   o   ma'nolis]
         where is.hospitalized-3SG the-NOM   Manolis-NOM
         "Where is Manolis hospitalized?"
         Target phrase
         [o   ma'nolis   nosi'levete   sto   iatri'ko]
         the-NOM Manolis-NOM is.hospitalized-3SG at.the-ACC Iatriko-ACC
         "Manolis is hospitalized at Iatriko."

2.   *Trigger phrase*
         [pu   nosi'levode   i   'ðio   'fili   tu]
         where are.hospitalized-3PL the-NOM   two-NOM friends-ACC his-GEN
         "Where are his two friends hospitalized?"
         Target phrase
         [o   ði'mitris   nosi'levete   sto   i'jia]
         the-NOM Dimitris-NOM is.hospitalized-3SG at.the-ACC Ygeia-ACC
         [o   ma'nolis   nosi'levete   sto   iatri'ko]
         the-NOM Manolis-NOM is.hospitalized-3SG at.the-ACC Iatriko-ACC
         "Dimitris is hospitalized at Ygeia. Manolis is hospitalized at Iatriko."

3.   *Context*
         "The conversation is about a car accident that one of your friends had.
         Your interlocutor has misunderstood and is under the impression that
         Dimitris had an accident and is now hospitalized, while in fact it was
         Manolis who had the accident. So your interlocutor wants to know
         where Dimitris is hospitalized. However, it is Manolis who is
         hospitalized. You need to correct this misconception and at the same
         time answer where Manolis is hospitalized."
         Trigger phrase
         [o   ði'mitris   pu   nosi'levete]
         the-nom   Dimitris-nom   where   is.hospitalized-3sg
         "Where is Dimitris hospitalized?"
         Target phrase
         [o   ma'nolis   nosi'levete   sto   iatri'ko]
         the-NOM   Manolis-NOM   is.hospitalized-3SG   at.the-ACC   Iatriko-ACC
         "Manolis is hospitalized at Iatriko."

4.   *Trigger phrase*
         [pços   nosi'levete   sto   iatri'ko]
         who   is.hospitalized-3SG   at.the-ACC   Iatriko-ACC
         "Who is hospitalized at Iatriko?"
         Target phrase
         [o   ma'nolis   nosi'levete   sto   iatri'ko]
         the-NOM   Manolis-NOM   is.hospitalized-3SG   at.the-ACC   Iatriko-ACC
         "Manolis is hospitalized at Iatriko."

5.   *Trigger phrase*
         [pços   nosi'levete   sto   iatri'ko]
         who   is.hospitalized-3SG   at.the-ACC   Iatriko-ACC
         [o   ma'nolis   'i   o   ði'mitris]
         the-NOM   Manolis-NOM   or   the-NOM   Dimitris-NOM
         "Who is hospitalized at Iatriko? Manolis or Dimitris?"
         Target phrase
         [o   ma'nolis   nosi'levete   sto   iatri'ko]
         the-NOM   Manolis-NOM   is.hospitalized-3SG   at.the-ACC   Iatriko-ACC
         "Manolis is hospitalized at Iatriko."

6.   *Context*
        "The interlocutor has misunderstood."
        Trigger phrase
        [o   ði'mitris   nosi'levete   sto   iatri'ko]
        the-NOM   Dimitris-NOM   is.hospitalized-3SG   at.the-ACC   Iatriko-ACC
        "Dimitris is hospitalized at Iatriko."
        Target phrase
        [o   ma'nolis   nosi'levete   sto   iatri'ko]
        the-NOM   Manolis-NOM   is.hospitalized-3SG   at.the-ACC   Iatriko-ACC
        "Manolis is hospitalized at Iatriko."

Lexical set 3

1.   *Trigger phrase*
        [o   ipo'pliarxos   ti   'ekane]
        the-NOM   lieutenant-NOM   what   do-3SG
        "What did the lieutenant do?"
        Target phrase
        [o   ipo'pliarxos   'ðjetakse   tin   e'cenosi
        the-NOM   lieutenant-NOM   order-3SG   the-ACC   evacuation-ACC
        tu   'pliu]
        the-GEN   ship-GEN
        "The lieutenant ordered the evacuation of the ship."

2.   *Trigger phrase*
        [ti   'ekanan i   'ðio   aksiomati'ci]
        what   do-3PL   the-NOM   two-NOM   officers-NOM
        "What did the two officers do?"
        Target phrase
        [o   mixani'kos   iðo'piise   tin   aktofila'ci]
        the-NOM   mechanic-NOM   notify-3SG   the-ACC   coastguard-ACC
        [o   ipo'pliarxos   'ðjetakse   tin   e'cenosi
        the-NOM   lieutenant-NOM   order-3SG   the-ACC   evacuation-ACC
        tu   'pliu]
        the-GEN   ship-GEN
        "The mechanic notified the coastguard. The lieutenant ordered the
        evacuation of the ship."

3.   *Context*
        "The conversation is about a boat accident outside Piraeus port. Your
        interlocutor has misunderstood and is under the impression that during
        the accident the mechanic was on the bridge giving orders, while in fact
        it was the lieutenant who was on the bridge. So your interlocutor wants
        to know the order that was given, however he/she thinks the order was
        given by the mechanic. You need to correct this misconception and at the
        same time answer what it was that the lieutenant ordered."
        Trigger phrase
        [o   mixani'kos   ti   'ðjetakse]
        the-NOM   mechanic-NOM   what   order-3SG
        "What did the mechanic order?"
        Target phrase
        [o   ipo'pliarxos   'ðjetakse   tin   e'cenosi
        the-NOM   lieutenant-NOM   order-3SG   the-ACC   evacuation-ACC
        tu   'pliu]
        the-GEN   ship-GEN
        "The lieutenant ordered the evacuation of the ship."

4.   *Trigger phrase*
        [pços   'ðjetakse   tin   e'cenosi   tu   'pliu]
        who-NOM   order-3SG   the-ACC   evacuation-ACC   the-GEN   ship-GEN
        "Who ordered the evacuation of the ship?"
        Target phrase
        [o   ipo'pliarxos   'ðjetakse   tin   e'cenosi
        the-NOM   lieutenant-NOM   order-3SG   the-ACC   evacuation-ACC
        tu   'pliu]
        the-GEN   ship-GEN
        "The lieutenant ordered the evacuation of the ship."

5.   *Trigger* phrase
        [pços   'ðjetakse   tin   e'cenosi   tu   'pliu
        who-NOM order-3SG the-ACC evacuation-ACC the-GEN ship-GEN
        o   ipo'pliarxos   'i   o   mixani'kos]
        the-NOM lieutenant-NOM   or the-NOM mechanic-NOM
        "Who ordered the evacuation of the ship? The lieutenant or the
        mechanic?"
        Target phrase
        [o   ipo'pliarxos   'ðjetakse   tin   e'cenosi
        the-NOM lieutenant-NOM   order-3SG the-ACC evacuation-ACC
        tu   'pliu]
        the-GEN   ship-GEN
        "The lieutenant ordered the evacuation of the ship."

6.   *Context*
        "The interlocutor has misunderstood."
        Trigger phrase
        [o   mixani'kos   'ðjetakse   tin   e'cenosi
        the-NOM mechanic-NOM order-3SG the-ACC evacuation-ACC
        tu   'pliu]
        the-GEN   ship-GEN
        "The mechanic ordered the evacuation of the ship."
        Target phrase
        [o   ipo'pliarxos   'ðjetakse   tin   e'cenosi
        the-NOM lieutenant-NOM   order-3SG the-ACC evacuation-ACC
        tu   'pliu]
        the-GEN   ship-GEN
        "The lieutenant ordered the evacuation of the ship."

Lexical set 4

1.   *Trigger phrase*
        [ti   mele'tuse   o   jeo'loɣos]
        what study-3SG the-NOM   geologist-NOM
        "What did the geologist study?"
        Target phrase
        [o   jeo'loɣos   mele'tuse   apoksira'menes 'limnes]
        the-NOM geologist-NOM study-3SG dried-ACC   lakes-ACC
        "The geologist studied dried lakes."

2.   *Trigger phrase*
        [ti   mele'tusan   i   'ðio   epi'stimones]
        what study-3PL   the-NOM two-nom scientists-NOM
        "What did the two scientists study?"
        Target phrase
        [o   perivalodo'loɣos   mele'tuse tin   pa'niða
        the-nom environmentalist-nom   study-3sg the-acc fauna-acc
        tis   perio'çis]
        the-gen area-gen
        [o   jeo'loɣos   mele'tuse apoksira'menes 'limnes]
        the-NOM geologist-NOM study-3SG dried-ACC   lakes-ACC
        "The environmentalist studied the fauna of the area. The geologist
        studied dried lakes."

3.   *Context*
        "The conversation is about some scientific experiments that took place in
        the area. Your interlocutor has misunderstood and is under the
        impression that the experiments were conducted by an environmentalist,
        while in fact they were conducted by a geologist. So your interlocutor
        wants to know what the environmentalist studied. However it was a
        geologist who conducted the studies. You need to correct this
        misconception and at the same time answer what it was that the geologist
        studies."
        Trigger phrase
        [ti   mele'tuse o   perivalodo'loɣos]
        what study-3SG the-NOM   environmentalist-NOM
        "What did the environmentalist study?"
        Target phrase
        [o   jeo'loɣos   mele'tuse apoksira'menes 'limnes]
        the-NOM geologist-NOM study-3SG dried-ACC   lakes-ACC
        "The geologist studied dried lakes."

4.   *Trigger phrase*
        [pços   mele'tuse apoksira'menes 'limnes]
        who   study-3SG dried-ACC   lakes-ACC"
        "Who studied dried lakes?"
        Target phrase
        [o   jeo'loɣos   mele'tuse apoksira'menes 'limnes]
        the-NOM geologist-NOM study-3SG dried-ACC   lakes-ACC
        "The geologist studied dried lakes."

5.   *Trigger phrase*
        [pços   mele'tuse   apoksira'menes   'limnes
        who   study-3SG   dried-ACC   lakes-ACC"
        o   jeo'loɣos   'i   o   perivalodo'loɣos]
        the-NOM geologist-NOM or the-NOM environmentalist-NOM
        "Who studied dried lakes? The geologist or the environmentalist?"
        Target phrase
        [o   jeo'loɣos   mele'tuse   apoksira'menes   'limnes]
        the-NOM geologist-NOM   study-3SG   dried-ACC   lakes-ACC
        "The geologist studied dried lakes."

6.   *Context*
        "The interlocutor has misunderstood."
        Trigger phrase
        [o   perivalodo'loɣos   mele'tuse   apoksira'menes   'limnes]
        the-NOM environmentalist-NOM   study-3SG   dried-ACC   lakes-ACC
        "The environmentalist studied dried lakes."
        Target phrase
        [o   jeo'loɣos   mele'tuse   apoksira'menes   'limnes]
        the-NOM geologist-NOM   study-3SG   dried-ACC   lakes-ACC
        "The geologist studied dried lakes."

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